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(54) APPARATUS FOR PASSING PREDETERMINED  
 VOLUMES OF FLUID

(71) We, EDWARD WILLIAMS (HOLDINGS) LIMITED, of Windsor House, Temple Row, Birmingham, 2, formerly of Dale Road, Selly Oak, Birmingham, 29, a British Company, declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for passing intermittently and repetitively predetermined volumes of fluid, and has for its object to provide convenient apparatus particularly suitable for passing predetermined volumes of fluid to or from a hydraulic ram or linear or rotary actuator so as to cause the ram or actuator to partake of predetermined incremental movements.

Apparatus for passing intermittently predetermined volumes of fluid and according to the invention comprises in combination, a cylinder, a first piston movable within the cylinder, a first rod on the first piston extending from one end of the cylinder, an adjustable first stop on the first rod, an annular second piston surrounding the first rod, said second piston being movable within the cylinder between the first piston and the first stop, a second rod on the first piston extending from the opposite end of the cylinder to the first rod, a second stop on the second rod arranged to make contact with the adjacent end of the cylinder to limit movement of the first piston from said adjacent end, a pair of ports at opposite ends of the cylinder respectively alternately connectible respectively to exhaust and a source of fluid under pressure, a first port intermediate the ends of the cylinder through which a volume of fluid determined by the position of the first stop can enter the cylinder between the first and

second pistons from said adjacent end of the cylinder through a non-return valve when the second stop is in contact with said adjacent end of the cylinder, and a second port intermediate the ends of the cylinder which is in communication with the space between the two pistons only when said one piston is at the limit of its travel towards said adjacent end, and through which fluid entrapped between the two pistons can be discharged as a result of relative movement of the pistons.

The accompanying drawings is a longitudinal sectional view of one example of the invention.

The apparatus shown is intended to control the admission of fluid to a ram or actuator.

Referring to the drawing there is provided a cylinder 30 the opposite ends of which are closed by closures 31, and 32 respectively. Within the cylinder 30 is a piston 33 from opposite ends of which axial rods 34 and 35 extend respectively through the closures 31 and 32. The rod 34 is screw threaded to receive an adjustable screw stop 36 and associated locknut 37, whilst the rod 35 is screw threaded to receive an internally screw-threaded sleeve 38 provided with a hand wheel 39. Surrounding the rod 35 is an annular piston 40 which is movable within the cylinder between the piston 33 and the adjacent end of the sleeve 38.

At opposite ends of the cylinder 30 are two ports 41, 42 which are alternately connectible to a source of fluid under pressure and to a reservoir respectively, by means of a solenoid actuated valve 43. Also in the cylinder wall are a pair of axially spaced ports 44, 45 which are connected by a non-return valve 46 and a further port 47 situated axially intermediate the ports 44 and 45 and connected to the ram or actuator to be controlled.

[Price 25p]

In operation, when the valve 43 is moved from the position shown to the alternative position, fluid from the source is admitted to the port 41 thereby causing the two pistons to move to the right as viewed in the drawing, until the stop 36 contacts the closure 31 to prevent further movement of the piston 33. In this position, the port 44 is uncovered and the port 47 is covered by the piston 33, and the port 45 is in register with an annular peripheral groove at the end of the piston 40 adjacent the piston 33. As a result, fluid from the port 41 can flow via the non-return valve 46 to the space between the two pistons thereby moving the piston 40 into contact with the sleeve 38. There is thus entrapped between the two pistons, a volume of fluid dependent upon the setting of the sleeve 38 upon the rod 35. When the solenoid valve 43 is actuated to return to the position shown, the two pistons initially move together to the left as viewed in the drawing with the entrapped fluid between them. When the piston 33 has reached the limit of its travel, continued movement of the piston 40 will cause entrapped fluid to be discharged through the port 47 to the ram or actuator to impart a predetermined increment of movement thereto.

It will be appreciated that by making the bore of the cylinder 30 small in relation to the diameter of the ram, or to the volume of fluid in the actuator, small and precise increments can be imparted to the ram or actuator to control for example, the depth of cut of a machine tool, or to position the platforms, tables, tools or work-pieces of machine tools. Moreover, whilst the invention has particular application to the control of fluid actuated rams or actuators, it could be used in any instance where it was required to pass intermittently predetermined volumes of liquid.

#### WHAT WE CLAIM IS:—

1. Apparatus for passing intermittently

and repetitively predetermined volumes of fluid comprising in combination, a cylinder, a first piston movable within the cylinder, a first rod on the first piston extending from one end of the cylinder, an adjustable first stop on the first rod, an annular second piston surrounding the first rod, said second piston being movable within the cylinder between the first piston and the first stop, a second rod on the first piston extending from the opposite end of the cylinder to the first rod, a second stop on the second rod arranged to make contact with the adjacent end of the cylinder to limit movement of the first piston from said adjacent end, a pair of ports at opposite ends of the cylinder respectively alternately connectible respectively to exhaust and a source of fluid under pressure, a first port intermediate the ends of the cylinder through which a volume of fluid determined by the position of the first stop can enter the cylinder between the first and second pistons from said adjacent end of the cylinder through a non-return valve when the second stop is in contact with said adjacent end of the cylinder, and a second port intermediate the ends of the cylinder which is in communication with the space between the two pistons only when said one piston is at the limit of its travel towards said adjacent end, and through which fluid entrapped between the two pistons can be discharged as a result of relative movement of the pistons.

2. Apparatus for passing intermittently predetermined volumes of fluid comprising the combination and arrangement of parts substantially as described with reference to the accompanying drawing.

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